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TRANSITION CURVES

Approved

Jno. F. Stevens
Chief Engr.
Oct 1900

Engineering Library

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Transition Curves

First Method

The following Tables give Offsets for placing Transition Curves at ends of circular curves from 1° to 10° inclusive.

They are based on "Wellington's Transition Curve" which is defined as "A curve starting with an infinite radius at the P.C. having a degree at every point in direct proportion to the distance from the P.C. until, at the P.C.C. where it connects with the Main Curve it is of the same degree as that curve" Three Tables are given.

Table I	Transition Curve	120' long
" II	"	180' "
" III	"	240' "

In general use these tables as follows:
Use Table I for curves that are to be elevated 2 in. or less.
Use Table II for curves that are to be elevated from 2 in. to 3 in.
Use Table III for curves that are to be elevated more than 3 in.

These Transitions are to be staked out as follows.

Run in the regular curve in the usual way. Decide whether to use I. II. or III, then following the diagram at the head of the table, set stakes at the points indicated in the tangent and the main curve and apply the offsets given in the table for each particular point. Setting center stakes at each 30ft in the Transition Curve and each 50ft in the Main Curve.

The Main Curve from P.C.C. at one end to P.C.C. at the other end, is to be set in by the amount of offset "O"

Set guard stakes and mark them for the P.T.C. and the P.C.C.

The Elevation of outer rail is to begin at the P.T.C. and gradually increase, until at the P.C.C. the full elevation for the Main Curve is obtained.

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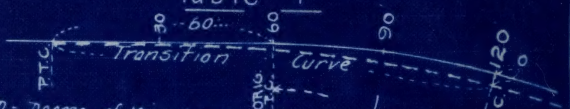
TRANSITION CURVE 120 LONG

Table 1

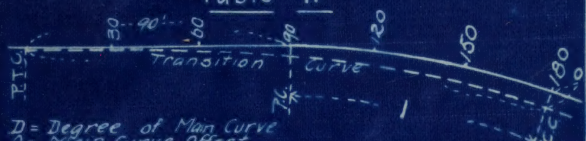


D = Degree of Main Curve
O = Main Curve Offset
I = Angle Consumed by Transition Curve

D	O	I	OFFSETS AT DISTANCES FROM P.T.C.			
			P.T.C.	30	60	90	120
1°	.10	0°36'	0.00	.01	.03	.09	.10
10'	.12	0°42'		.01	.06	.11	.12
20'	.14	0°48'		.01	.07	.13	.14
30'	.16	0°54'		.01	.08	.15	.16
40'	.17	1°00'		.01	.09	.16	.17
50'	.19	1°06'		.01	.10	.18	.19
2°	.20	1°12'		.01	.11	.20	.21
10'	.22	1°18'		.02	.12	.21	.23
20'	.24	1°24'		.02	.13	.22	.24
30'	.26	1°30'		.02	.13	.24	.26
40'	.28	1°36'		.02	.14	.26	.28
50'	.29	1°42'		.02	.15	.28	.30
3°	.31	1°48'		.02	.16	.29	.31
10'	.33	1°54'		.02	.17	.31	.33
20'	.35	2°00'		.02	.18	.33	.35
30'	.36	2°06'		.02	.18	.34	.36
40'	.38	2°12'		.02	.19	.36	.38
50'	.40	2°18'		.03	.20	.37	.40
4°	.42	2°24'		.03	.21	.39	.42
10'	.43	2°30'		.03	.22	.40	.43
20'	.45	2°36'		.03	.23	.42	.45
30'	.47	2°42'		.03	.24	.44	.47
40'	.48	2°48'		.03	.25	.46	.49
50'	.50	2°54'		.03	.25	.47	.50
5°	.52	3°00'		.03	.26	.49	.52
10'	.54	3°06'		.03	.27	.51	.54
20'	.56	3°12'		.04	.28	.52	.56
30'	.58	3°18'		.04	.29	.53	.57
40'	.59	3°24'		.04	.30	.55	.59
50'	.61	3°30'		.04	.31	.57	.61
6°	.62	3°36'		.04	.31	.58	.62
10'	.64	3°42'		.04	.32	.60	.64
20'	.66	3°48'		.04	.33	.62	.66
30'	.68	3°54'		.04	.34	.64	.68
40'	.69	4°00'		.04	.35	.65	.69
50'	.71	4°06'		.05	.36	.66	.71
7°	.73	4°12'		.05	.37	.68	.73
10'	.73	4°18'		.05	.38	.70	.73
20'	.76	4°24'		.05	.38	.71	.76
30'	.78	4°30'		.05	.39	.73	.78
40'	.80	4°36'		.05	.40	.75	.80
50'	.81	4°42'		.05	.41	.77	.82
8°	.83	4°48'		.05	.42	.78	.83
10'	.83	4°54'		.05	.43	.80	.85
20'	.87	5°00'		.06	.44	.81	.87
30'	.88	5°06'		.06	.44	.82	.88
40'	.90	5°12'		.06	.45	.84	.90
50'	.92	5°18'		.06	.46	.86	.92
9°	.94	5°24'		.06	.47	.88	.94
10'	.95	5°30'		.06	.48	.89	.95
20'	.97	5°36'		.06	.49	.91	.97
30'	.99	5°42'		.06	.50	.93	.99
40'	1.01	5°48'		.06	.51	.95	1.01
50'	1.02	5°54'		.06	.51	.96	1.02
10°	1.04	6°00'		.07	.52	.97	1.04

TRANSITION CURVE 180' LONG

Table II

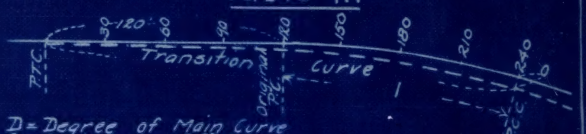


D = Degree of Main Curve
O = Main Curve Offset
I = Angle Consumed by Transition Curve

D	O	I	OFFSETS AT DISTANCES FROM P.T.C.					
			P.T.C	30	60	90	120	150	180
1°	.22	0°34'	0.00	.01	.02	.14	.15	.22	.22
10'	.24	1°08'		.01	.04	.14	.23	.23	.24
20'	.31	12		.01	.05	.16	.26	.30	.31
30'	.33	21		.01	.05	.18	.30	.32	.33
40'	.39	30		.01	.06	.20	.33	.38	.39
50'	.39	39		.01	.07	.22	.36	.37	.39
2°	.39	48		.01	.07	.24	.40	.46	.47
10'	.51	57		.01	.08	.25	.43	.50	.51
20'	.52	2°06'		.01	.08	.28	.46	.53	.56
30'	.59	15		.01	.09	.30	.50	.62	.59
40'	.62	24		.01	.09	.31	.52	.61	.62
50'	.66	33		.01	.10	.33	.56	.65	.66
3°	.70	42		.01	.10	.35	.60	.68	.70
10'	.74	51		.01	.11	.37	.63	.72	.74
20'	.77	3°00'		.01	.12	.39	.66	.77	.78
30'	.82	09		.02	.12	.41	.70	.80	.82
40'	.86	18		.02	.13	.43	.74	.84	.86
50'	.90	27		.02	.13	.45	.77	.88	.90
4°	.94	36		.02	.14	.47	.80	.92	.94
10'	.98	45		.02	.15	.49	.83	.95	.98
20'	1.01	54		.02	.15	.51	.86	.99	1.01
30'	1.03	4°03'		.02	.16	.53	.89	1.03	1.03
40'	1.09	12		.02	.16	.55	.93	1.07	1.09
50'	1.13	21		.02	.17	.57	.96	1.11	1.13
5°	1.17	30		.02	.17	.59	1.00	1.15	1.17
10'	1.21	39		.02	.18	.61	1.03	1.19	1.21
20'	1.23	48		.02	.19	.63	1.06	1.23	1.25
30'	1.29	57		.02	.19	.65	1.10	1.27	1.29
40'	1.33	5°06'		.03	.20	.67	1.13	1.30	1.33
50'	1.37	15		.03	.20	.69	1.17	1.34	1.37
6°	1.41	24		.03	.21	.71	1.20	1.38	1.41
10'	1.44	33		.03	.21	.74	1.23	1.41	1.44
20'	1.48	42		.03	.22	.76	1.26	1.45	1.48
30'	1.52	51		.03	.23	.78	1.29	1.49	1.52
40'	1.56	6°00'		.03	.23	.80	1.32	1.53	1.56
50'	1.60	09		.03	.24	.82	1.36	1.57	1.60
7°	1.64	18		.03	.25	.84	1.40	1.61	1.64
10'	1.68	27		.03	.25	.86	1.43	1.65	1.68
20'	1.72	36		.03	.26	.88	1.46	1.69	1.72
30'	1.76	45		.03	.26	.90	1.50	1.73	1.76
40'	1.80	54		.03	.27	.91	1.53	1.77	1.80
50'	1.83	7°03'		.03	.27	.93	1.56	1.80	1.83
8°	1.87	12		.03	.28	.95	1.59	1.83	1.87
10'	1.91	21		.03	.28	.97	1.62	1.87	1.91
20'	1.95	30		.04	.29	.99	1.65	1.91	1.95
30'	1.99	39		.04	.30	1.00	1.69	1.95	1.99
40'	2.03	48		.04	.30	1.02	1.72	1.99	2.03
50'	2.07	57		.04	.31	1.04	1.76	2.03	2.07
9°	2.11	8°06'		.04	.31	1.06	1.79	2.07	2.11
10'	2.15	15		.04	.32	1.08	1.82	2.11	2.15
20'	2.19	24		.04	.33	1.10	1.86	2.15	2.19
30'	2.22	33		.04	.33	1.12	1.89	2.18	2.22
40'	2.26	42		.04	.34	1.13	1.92	2.22	2.26
50'	2.30	51		.04	.34	1.15	1.96	2.26	2.30
10°	2.34	9°00'		.04	.35	1.17	1.99	2.30	2.34

TRANSITION CURVE 240' LONG

Table III



D = Degree of Main Curve
O = Main Curve Offset
I = Angle Consumed by Transition Curve

D	O	I	OFFSETS AT DISTANCES FROM P.T.C.								
			P.T.C.	30	60	90	120	150	180	210	240
1°	.32	1° 12'	0.00	.01	.03	.09	.21	.39	.64	.97	1.39
10'	.40	24'		.01	.03	.11	.24	.44	.72	1.08	1.54
20'	.53	36'		.01	.04	.12	.28	.49	.80	1.20	1.70
30'	.62	48'		.01	.04	.13	.31	.55	.89	1.33	1.87
40'	.69	2°		.01	.04	.15	.33	.60	.97	1.45	2.04
50'	.76	12'		.01	.05	.16	.36	.65	1.05	1.57	2.20
2°	.89	24'		.01	.05	.18	.42	.75	1.21	1.81	2.54
10'	.90	36'		.01	.06	.19	.45	.81	1.31	1.96	2.75
20'	.94	48'		.01	.06	.21	.49	.86	1.39	2.08	2.92
30'	1.04	3°		.01	.07	.22	.52	.92	1.49	2.23	3.13
40'	1.11	12'		.01	.07	.24	.56	.97	1.57	2.35	3.30
50'	1.18	24'		.01	.07	.25	.59	1.04	1.69	2.53	3.55
3°	1.25	36'		.01	.08	.27	.63	.90	1.74	2.61	3.66
10'	1.32	48'		.01	.08	.28	.66	1.04	1.68	2.51	3.52
20'	1.39	4°		.01	.09	.30	.70	1.09	1.76	2.63	3.69
30'	1.46	12'		.01	.09	.31	.73	1.15	1.85	2.77	3.88
40'	1.53	24'		.01	.10	.32	.77	1.21	1.95	2.92	4.09
50'	1.60	36'		.01	.10	.34	.80	1.26	2.03	3.04	4.26
4°	1.67	48'		.01	.11	.35	.84	1.32	2.13	3.19	4.47
10'	1.73	5°		.01	.11	.37	.87	1.36	2.19	3.28	4.60
20'	1.80	12'		.01	.11	.38	.90	1.42	2.29	3.43	4.81
30'	1.87	24'		.01	.12	.40	.94	1.47	2.37	3.55	4.98
40'	1.94	36'		.02	.12	.41	.97	1.53	2.46	3.69	5.17
50'	2.01	48'		.02	.13	.43	1.01	1.58	2.55	3.82	5.36
5°	2.08	6°		.02	.13	.44	1.04	1.64	2.65	3.96	5.55
10'	2.15	12'		.02	.14	.46	1.08	1.69	2.73	4.09	5.73
20'	2.22	24'		.02	.14	.47	1.11	1.75	2.82	4.22	5.92
30'	2.29	36'		.02	.14	.49	1.15	1.80	2.91	4.36	6.11
40'	2.36	48'		.02	.15	.50	1.18	1.86	2.99	4.48	6.28
50'	2.43	7°		.02	.15	.52	1.22	1.91	3.08	4.61	6.47
6°	2.50	12'		.02	.16	.53	1.25	1.97	3.18	4.76	6.67
10'	2.57	24'		.02	.16	.54	1.29	2.02	3.26	4.88	6.84
20'	2.64	36'		.02	.17	.56	1.32	2.08	3.35	5.02	7.03
30'	2.71	48'		.02	.17	.57	1.36	2.14	3.44	5.16	7.23
40'	2.77	8°		.02	.17	.59	1.39	2.18	3.52	5.28	7.40
50'	2.84	12'		.02	.18	.60	1.42	2.24	3.61	5.41	7.59
7°	2.91	24'		.02	.18	.62	1.46	2.29	3.70	5.55	7.79
10'	2.98	36'		.02	.19	.63	1.49	2.35	3.79	5.68	7.97
20'	3.05	48'		.02	.19	.64	1.53	2.40	3.87	5.81	8.15
30'	3.12	9°		.02	.20	.66	1.56	2.46	3.96	5.94	8.34
40'	3.19	12'		.03	.20	.68	1.60	2.51	4.05	6.08	8.53
50'	3.26	24'		.03	.20	.69	1.63	2.57	4.14	6.21	8.72
8°	3.33	36'		.03	.21	.70	1.67	2.62	4.23	6.34	8.91
10'	3.40	48'		.03	.21	.72	1.70	2.68	4.32	6.48	9.10
20'	3.47	10°		.03	.22	.73	1.74	2.74	4.41	6.62	9.29
30'	3.54	12'		.03	.22	.75	1.77	2.79	4.50	6.75	9.48
40'	3.61	24'		.03	.23	.76	1.81	2.85	4.59	6.89	9.67
50'	3.68	36'		.03	.23	.78	1.84	2.91	4.68	7.02	9.86
9°	3.75	48'		.03	.24	.79	1.88	2.96	4.77	7.16	10.05
10'	3.82	11°		.03	.24	.81	1.91	3.02	4.86	7.29	10.24
20'	3.89	12'		.03	.24	.82	1.94	3.08	4.95	7.43	10.43
30'	3.95	24'		.03	.25	.84	1.98	3.13	5.04	7.56	10.62
40'	4.02	36'		.03	.25	.85	2.01	3.19	5.13	7.70	10.81
50'	4.09	48'		.03	.26	.86	2.05	3.24	5.22	7.83	11.00
10°	4.16	12°		.03	.26	.88	2.08	3.30	5.31	7.97	11.19

Transition Curves
Second Method

Where it is not practicable to set the entire curve in as provided for in the preceding tables, the following tables may be used:

Table IV is based on using Transition Curve 120ft long, given in Table I, running into a Compound Curve 10 min. sharper than the Main Curve, then into the Main Curve in its original position. Thus: for a 3° Curve we have 120ft of Transition Curve, fitting a 3°10' curve, then 86.5 ft of 3°10' curve, running into the original 3° Curve at a point 206.5 ft from orig. P.C.

Table V is based on using Transition Curve 180ft long given in Table II running into a Compound Curve 10 min sharper than the Main Curve then into the Main Curve in its original position. Thus: for a 3° Curve we have 180 ft of Transition Curve fitting a 3°10' curve then 129.9 ft of 3°10' curve running into the original 3° Curve at a point 309.9 ft from orig. P.C.

Table VI is based on using Transition Curve 240 ft long given in Table III running into a Compound Curve 10 min. sharper than the Main Curve then into the Main Curve in its original position. Thus: for a 3° Curve we have 240 ft of Transition Curve fitting a 3°10' curve then 173.4 ft of 3°10' curve running into the original 3° curve at a point 413.4 ft from orig. P.C.

In general use 120ft Transition where curve is to be elevated 2 in. or less.

Use 180ft Transition where curve is to be elevated from 2 to 3 in.

Use 240 ft Transition where curve is to be elevated more than 3 in.

The selection of Transition Curve to be used in any particular case will not always be governed by the elevation to be given to the outer rail. The distance which the track can be thrown without necessating too much additional work in excavation or embankment will often determine which Transition Curve to use, or a bridge on which the track can not be thrown much will govern.

The Diagrams show how the stakes are to be set for these Transition Curves.

The beginning of Transition Curve should be marked P.T.C. and the end P.C.C. The elevation of the outer rail beginning at the former point and gradually increasing until full elevation for the Main Curve is obtained at the latter point.

10	7°29	53.1	179.7	03	.21	.27	.19	.10	.04	.01				232.8
20	7°58	53.2	183.0	03	.22	.28	.20	.11	.05	.01				236.2
30	8°23	53.4	186.3	03	.23	.30	.21	.12	.05	.01				239.7
40	8°51	53.5	189.5	03	.25	.31	.22	.13	.06	.02				243.2
50	9°18	53.6	192.6	03	.26	.32	.23	.13	.06	.02				246.2
5°	9°47	53.7	195.8	03	.28	.34	.25	.14	.07	.02				249.5
10	10°16	53.8	198.8	04	.29	.35	.26	.15	.08	.03				252.6
20	10°46	53.9	201.7	04	.29	.36	.27	.16	.08	.03				255.6
30	11°16	54.0	204.8	04	.28	.38	.28	.17	.09	.03	.01			258.8
40	11°46	54.1	207.7	04	.29	.39	.29	.18	.10	.04	.01			261.8
50	12°17	54.2	210.7	04	.30	.40	.31	.19	.10	.04	.01			264.7
6°	12°49	54.3	213.5	04	.30	.42	.32	.20	.11	.05	.01			267.8
10	13°20	54.4	216.3	04	.31	.43	.33	.21	.12	.05	.01			270.7
20	13°52	54.4	219.1	04	.32	.45	.34	.22	.13	.06	.02			273.3
30	14°25	54.5	221.9	04	.33	.46	.36	.23	.13	.06	.02			276.4
40	14°58	54.6	224.5	05	.34	.48	.37	.24	.14	.07	.02			279.1
50	15°32	54.7	227.2	05	.35	.49	.38	.25	.15	.07	.03			281.9
7°	16°06	54.7	230.0	05	.36	.50	.39	.26	.16	.08	.03			284.7
10	16°43	54.8	232.6	05	.37	.52	.41	.28	.17	.09	.03			287.4
20	17°15	54.9	235.2	05	.37	.53	.42	.29	.18	.09	.04	.01		290.1
30	17°50	54.9	237.9	05	.38	.54	.43	.30	.18	.10	.04	.01		292.8
40	18°26	55.0	240.4	05	.39	.56	.45	.31	.19	.11	.04	.01		295.4
50	19°02	55.0	242.8	05	.40	.57	.46	.32	.20	.11	.05	.01		297.8
8°	19°39	55.1	245.6	05	.41	.59	.47	.33	.21	.12	.05	.01		300.7
10	20°15	55.2	248.0	06	.42	.60	.49	.34	.22	.13	.06	.02		303.2
20	20°52	55.2	250.5	06	.43	.62	.50	.35	.23	.13	.06	.02		305.7
30	21°31	55.3	253.0	06	.43	.63	.52	.36	.24	.14	.07	.02		308.3
40	22°09	55.3	255.5	06	.44	.65	.53	.37	.25	.15	.07	.02		310.8
50	22°47	55.4	257.9	06	.45	.66	.54	.39	.26	.15	.08	.03		313.3
9°	23°26	55.4	260.4	06	.46	.67	.56	.40	.27	.16	.08	.03		315.8
10	24°05	55.4	262.8	06	.47	.69	.57	.41	.28	.17	.09	.03	.01	318.2
20	24°45	55.5	265.1	06	.48	.70	.58	.42	.29	.18	.09	.04	.01	320.6
30	25°26	55.6	267.6	06	.49	.72	.60	.44	.30	.18	.10	.04	.01	323.2
40	26°08	55.6	270.0	06	.50	.73	.61	.45	.31	.19	.11	.04	.01	325.6
50	26°47	55.6	272.3	07	.50	.75	.63	.46	.32	.20	.11	.05	.01	327.9
10°	27°29	55.7	274.7	07	.51	.76	.64	.47	.33	.21	.12	.05	.01	330.4

DIAGRAM OF TRANSITION CURVE 120' LONG

AS APPLIED TO A 3° CURVE

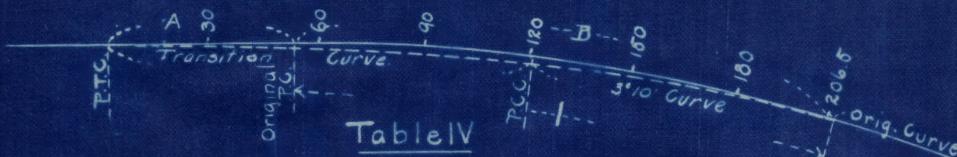


Table IV

D	I	A	B	OFFSETS AT DISTANCES FROM P.T.C.											Runs into Original Curve at
				P.T.C.	30	60	90	120	150	180	210	240	270	300	
1°	0°39	45.9	90.5	0.0	.01	.04	.04	.01							144.4
10'	1°13	46.9	104.5		.01	.05	.05	.02							151.4
20'	1°28	47.8	109.8		.01	.06	.06	.02							154.6
30'	1°43	48.5	115.0		.01	.07	.07	.03							160.3
40'	2°00	49.1	120.2		.01	.08	.08	.04	.01						169.3
50'	2°17	49.6	124.9		.01	.09	.09	.04	.01						174.5
2°	2°35	50.0	129.3		.02	.10	.10	.05	.01						179.5
10	2°54	50.4	134.2		.02	.11	.12	.06	.02						185.6
20	3°14	50.8	138.4		.02	.11	.13	.07	.02						190.2
30	3°34	51.1	142.6		.02	.12	.14	.08	.03						193.7
40	3°55	51.4	146.8		.02	.13	.15	.09	.03						198.2
50	4°16	51.6	150.8		.02	.14	.17	.10	.04	.01					202.4
3°	4°38	51.9	154.6		.02	.15	.18	.11	.05	.01					206.5
10	5°01	52.1	158.5		.02	.16	.19	.12	.05	.01					210.6
20	5°24	52.3	162.2		.02	.17	.20	.13	.06	.02					214.3
30	5°48	52.5	165.7		.02	.17	.22	.14	.07	.02					218.2
40	6°12	52.6	169.3		.03	.18	.23	.15	.08	.03					222.1
50	6°36	52.8	172.9		.03	.19	.24	.16	.08	.03					225.7
4°	7°01	53.0	176.4		.03	.20	.26	.17	.09	.04	.01				229.4

DIAGRAM OF TRANSITION CURVE 180' LONG

AS APPLIED TO A 3° CURVE

Table V

D	I	A	B	OFFSETS AT DISTANCES FROM P.T.C.																		Runs into Original Curve at
				P.T.C.	30	60	90	120	150	180	210	240	270	300	330	360	390	420	450	480		
1°	1°29'	68.8	148.1		01	02	10	10	06	02												216.9
10'	1°59'	70.4	136.5		01	03	12	12	08	03												226.9
20'	2°12'	71.7	164.8		01	03	14	15	10	03	01											236.3
30'	2°35'	72.7	172.7		01	04	16	17	13	06	02											245.4
40'	3°00'	73.6	180.2		01	07	18	20	15	08	03											253.8
50'	3°26'	74.4	187.4		01	07	20	22	17	10	04	01										261.8
2°	3°53'	75.1	194.4		01	08	22	25	20	12	05	01										269.5
10'	4°21'	75.7	201.1		01	08	23	28	23	14	06	02										276.8
20'	4°51'	76.2	207.6		01	09	25	30	25	16	08	03										283.8
30'	5°21'	76.6	214.0		01	09	27	33	28	18	09	04	01									290.6
40'	5°52'	77.1	220.2		01	10	29	36	31	20	11	05	01									297.3
50'	6°25'	77.5	226.2		01	10	31	38	33	22	13	06	02									303.7
3°	6°58'	77.8	232.1		01	11	33	41	36	25	15	07	02									309.9
10'	7°32'	78.1	237.8		01	12	35	44	39	27	16	08	03									315.9
20'	8°07'	78.4	243.4		02	12	37	47	41	29	18	10	04	01								321.8
30'	8°43'	78.7	248.9		02	13	39	50	44	32	20	11	05	01								327.6
40'	9°19'	79.0	254.2		02	13	41	53	47	34	22	13	06	02								333.2
50'	9°57'	79.2	259.5		02	14	43	56	50	37	24	14	07	02								338.7
4°	10°35'	79.5	264.6		02	15	45	59	53	39	26	16	08	03								344.1

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DIAGRAM OF TRANSITION CURVE 240' LONG

AS APPLIED TO A 3° MAIN CURVE

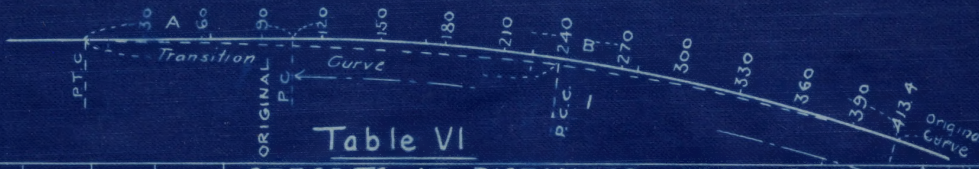

Table VI

D	I	A	B	OFFSETS AT DISTANCES FROM P.T.C.																			Runs into Original Curve at
				P_{T_C}	30	60	90	120	150	180	210	240	270	300	330	360	390	420	450	480	510	540	570	600	630	
1°	1°38	91.8	197.5	0.0	0.0	0.03	.10	.17	.18	.14	.09	.04	.01												289.3
10'	2°26	93.9	208.8		0.0	0.04	.12	.21	.22	.18	.12	.06	.02												302.7
20	2°56	95.6	219.7		0.0	0.04	.13	.24	.27	.23	.15	.08	.03												313.3
30	3°27	97.0	230.3		.01	0.04	.15	.28	.31	.27	.20	.11	.05	.01											327.3
40	4°00	98.2	240.3		.01	0.05	.16	.31	.36	.32	.24	.14	.07	.02											338.5
50	4°35	99.2	249.9		.01	0.05	.18	.35	.40	.36	.28	.17	.09	.04	.01										349.1
2°	5°11	100.1	259.3		.01	0.06	.19	.38	.45	.41	.32	.21	.12	.05	.01										359.4
10'	5°49	100.9	268.2		.01	0.06	.21	.42	.49	.46	.36	.24	.14	.07	.02										369.1
20	6°28	101.6	276.9		.01	0.07	.22	.45	.54	.51	.41	.28	.17	.09	.03										378.5
30	7°08	102.2	285.5		.01	0.07	.23	.49	.59	.56	.46	.32	.20	.11	.05	.01									387.7
40	7°51	102.7	294.5		.01	0.07	.25	.52	.63	.61	.50	.36	.24	.14	.07	.02									397.2
50	8°33	103.3	301.7		.01	0.08	.26	.56	.68	.66	.54	.40	.27	.16	.08	.03									403.0
3°	9°17	103.8	309.6		.01	0.08	.28	.59	.73	.71	.57	.44	.30	.19	.10	.04	.01								413.4
10'	10°03	104.2	317.3		.01	0.09	.29	.63	.78	.76	.64	.48	.33	.21	.12	.05	.01								421.3
20	10°50	104.6	324.9		.01	0.09	.30	.66	.83	.81	.69	.52	.37	.24	.14	.07	.02								429.5
30	11°37	105.0	332.1		.01	.10	.32	.69	.87	.86	.74	.57	.41	.27	.17	.09	.03								437.1
40	12°26	105.4	339.3		.01	.10	.34	.73	.92	.92	.79	.61	.44	.30	.19	.10	.04	.01							444.7
50	13°17	105.7	346.4		.01	.10	.35	.77	.97	.97	.84	.66	.48	.34	.22	.12	.06	.01							452.1
4°	14°08	106.0	353.3		.01	.11	.37	.80	1.02	1.02	.89	.70	.52	.37	.24	.14	.07	.02							459.3

Table for Elevating Outer Rail on Curves

Calculated from Henck's Formula

Degree of Curve	SPEED IN MILES PER HOUR									
	10	15	20	25	30	35	40	45	50	60
0°15'			1/16	1/8						
0°30'										
0°45'										
1°00'	1/16	1/8	1/4	5/16	3/8		1 1/16	1 3/8	1 7/8	2 3/8
1°15'	1/16	3/16	3/16	5/16	3/4	1	1 9/16	1 3/8	2 1/16	2 3/8
1°30'	1/16	3/16	3/8	5/8	15/16	1 1/4	1 9/16	2	2 1/2	3 1/16
1°45'	1/8	1/4	7/16	3/4	1 1/16	1 7/16	1 7/8	2 3/16	2 3/16	4 3/16
2°00'	1/8	5/16	1/2	3/4	1 3/16	1 5/8	2 1/16	2 1/16	3 3/16	4 3/4
2°15'	1/8	5/16	9/16	13/16	1 9/16	1 13/16	2 3/8	3	3 3/4	5
2°30'	1/8	3/8	5/8	1 1/16	1 1/2	2	2 1/16	3 3/16	4 1/16	
2°45'	3/16	3/8	3/4	1 3/16	1 1/16	2 1/4	2 7/16	3 1/16	4 1/16	
3°00'	3/16	7/16	13/16	1 1/4	1 13/16	2 1/16	3 3/16	4	4 13/16	
3°15'	3/16	7/16	7/8	1 3/8	1 15/16	2 3/8	3 1/16	4 3/16	5	
3°30'	3/16	1/2	15/16	1 7/16	2 1/8	2 7/8	3 3/4	4 1/16		
3°45'	1/4	9/16	1	1 1/16	2 1/4	3 1/16	4	5		
4°00'	1/4	5/16	1 1/16	1 5/8	2 3/8	3 1/4	4 1/4			
4°15'	1/4	5/8	1 1/8	1 3/4	2 1/2	3 7/16	4 1/2			
4°30'	1/4	5/8	1 3/16	1 7/8	2 1/16	3 1/16	4 3/4			
4°45'	5/16	11/16	1 1/4	2	2 3/16	3 3/8	5			
5°00'	5/16	11/16	1 5/16	2 1/16	2 5/16	3 1/2				
5°15'	5/16	3/4	1 3/8	2 3/16	3 1/8	4 1/16				
5°30'	5/16	3/4	1 7/16	2 5/16	3 3/16	4 1/2				
5°45'	3/8	3/4	1 1/2	2 7/16	3 5/16	4 11/16				
6°00'	3/8	7/8	1 9/16	2 1/2	3 7/16	4 7/8				
6°15'	3/8	7/8	1 5/8	2 5/8	3 1/16	5				
6°30'	3/8	7/8	1 11/16	2 11/16	3 7/8					
6°45'	7/16	1	1 3/4	2 3/4	4					
7°00'	7/16	1 1/16	1 7/8	2 7/8	4 1/16					
7°15'	7/16	1 1/16	1 15/16	3	4 1/16					
7°30'	7/16	1 1/8	2	3 1/8	4 1/2					
7°45'	1/2	1 1/8	2 1/16	3 1/4	4 9/16					
8°00'	1/2	1 3/16	2 1/8	3 5/16	4 3/4					
8°15'	1/2	1 3/16	2 3/16	3 7/16	4 7/8					
8°30'	9/16	1 1/4	2 1/4	3 1/2	5					
8°45'	9/16	1 1/4	2 5/16	3 5/8						
9°00'	5/8	1 5/16	2 3/8	3 11/16	MAXIMUM ELEVATION 5"					
9°15'	5/8	1 5/16	2 7/16	3 13/16						
9°30'	5/8	1 3/8	2 1/2	3 15/16						
9°45'	11/16	1 7/16	2 9/16	4 1/16						
10°00'	11/16	1 1/2	2 5/8	4 1/8						

Approved

GHG

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